

BAND SELECTION METHOD APPLIED TO M³ (MOON MINERALOGY MAPPER)
Patrick D. Cavanagh (Lin Li¹), Department of Electrical and Computer
Engineering, Purdue School of Engineering and Technology, Indiana
University–Purdue University Indianapolis, Indianapolis, Indiana 46202

Remote sensing optical sensors, such as those on board satellites and planetary probes, are able to detect and measure solar radiation at both improved spectral and spatial resolution. In particular, a hyperspectral dataset often consists of tens to hundreds of specified wavelength bands and contains a vast amount of spectral information for potential processing. One drawback of such a large spectral dataset is information redundancy resulting from high correlation between narrow spectral bands. Reducing the data dimensionality is critical in practical hyperspectral remote sensing applications.

Price's method is a band selection approach that uses a small subset of bands to accurately reconstruct the full hyperspectral dataset. The method seeks to represent the dataset by a weighted sum of basis functions. An iterative process is used to successively approximate the full dataset. The process ends when the last basis function no longer provides a significant contribution to the reconstruction of the dataset, i.e. the basis function is dominated by noise.

The research presented examines the feasibility of Price's method for extracting an optimal band subset from recently acquired lunar hyperspectral images recorded by the Moon Mineralogy Mapper (M³) instrument on board the Chandrayaan-1 spacecraft. The Apollo 17 landing site was used for testing of the band selection method.

Preliminary results indicate that the band selection method is able to successfully reconstruct the original hyperspectral dataset with minimal error. In a recent test case, 15 bands were used to reconstruct the original 74 bands of reflectance data. This represents an accurate reconstruction using only 20% of the original dataset.

The results from this study can help to configure spectral channels of future optical instruments for lunar exploration. The channels can be chosen based on the knowledge of which wavelength bands represent the greatest relevant information for characterizing geology of a particular location.

¹Department of Earth Sciences, Indiana University-Purdue University Indianapolis, Indianapolis, IN 46202